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ABSTRACT

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THE INFLUENCE OF SUBJECT MATTER EXPERTISE ON PEDAGOGICAL CONTENT KNOWLEDGE

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Abstract

This study investigated the role of subject matter expertise on the pedagogical content knowledge of physical education teachers. Data were collected through multiple interviews on ten teachers with expertise in at least one physical education subject area. Each teacher was interviewed four times, with each interview lasting approximately one hour. The interviews focused on the teachers' background in and familiarity with two physical education subject areas (one expert and one nonexpert area), perceptions of planning for and instructing in these subjects, and experiences teaching the subjects. Data were analyzed using the constant comparative technique (Glaser & Strauss, 1967) and the findings were presented with reference to Grossman's (1990) definition of pedagogical content knowledge. Subject experts identified their largest pedagogical problem as student motivation, while nonexperts believed finding appropriate activities was their greatest challenge. A greater ability for planning progressive learning activities and contingency plans was demonstrated by the subject experts. They were also able to accommodate a greater range of learner abilities.

THE INFLUENCE OF SUBJECT MATTER EXPERTISE ON PEDAGOGICAL CONTENT KNOWLEDGE

Stimulated by Shulman's (1986, 1987) seminal work, those concerned with teaching and teacher education have recently begun asking the question: what knowledge is most necessary for teaching? Researchers and scholars have been particularly keen to understand the role and influence of expertise in teaching (Berliner, 1986). Several research programs, most notably those at Stanford and Michigan State Universities, have studied these questions. But as Brophy (1991) noted, much work remains to be done in the area of teachers' knowledge. As many of the early studies were exploratory in nature, they focused on only a few case study teachers and were undertaken in a limited range of subject areas. Many teacher preparation and in-service programs center on general pedagogical skills and as Shulman (1987) insightfully observed "the management of behavior" has been the main focus for teacher education rather than "the management of ideas."

Currently our understanding of how teachers organize and present subject matter in actual practice, what Shulman (1987) termed pedagogical content knowledge, is shockingly sparse. Rovegno (1992) has conducted one of the very few studies of pedagogical content knowledge in physical education. She found that as future teachers begin shifting their focus from a general

conception of content to a more detailed level, they begin organizing content in progressive order. The aspiring teachers also recognized the difference between knowledge of a subject and knowledge to teach the subject. But precisely how disciplinary expertise mediates the way teachers organize and present subject matter remains largely unknown. The purpose of this study was, therefore, to investigate the influence of subject matter expertise on the pedagogical content knowledge of teachers in physical education.

Methods

Teachers. Ten physical education teachers with demonstrable expertise in at least one subject area in physical education (i.e., a sport or physical activity) participated in this study. The expertise of each teacher was assessed in three ways: (a) participation in the activity for a sustained period of time and in multiple capacities (e.g., coach, athlete, official), (b) background interview that probed the depth and breadth of subject matter knowledge, and (c) self identification of expertise by use of a subject area expertise rating scale.

The teachers were recruited from a list of possible participants that met the above criteria and were within reasonable proximity to the investigators. All participants were teaching in public elementary or middle schools at the time of this investigation. The formal teaching experience ranged from

student teaching to 26 years of experience. Prior to data collection, the teachers completed an approved Human Subject Inform Consent Form.

Expertise Checklist. A Subject Matter Expertise Checklist was devised to permit the teachers to assess their expertise in a variety of physical education content areas. Several sources and textbooks were consulted to cull an extensive listing of physical education content pertinent to elementary and middle school. The teachers were asked to rate their expertise (knowledge) in each of the 25 areas. Several blank spaces were included on the checklist to accommodate subjects taught that were not included on the original list. The teachers were asked to rate each area from 1 to 10, with 10 representing the highest level of expertise in the subject.

Interview Protocol. The teachers were interviewed four times using protocol based upon previous research on pedagogical content knowledge (Grossman, 1990). The interviews were conducted in private with the teacher and two investigators. Each interview lasted approximately one hour.

The first interview determined the subject's experience with and participation in physical activity as well as their general conceptions of teaching physical education. From these interviews and the completed rating scale, the investigators selected an expert and nonexpert subject area for each teacher.

The second interview required the teachers to plan two hypothetical middle school units; one unit in the teacher's area of expertise and one in a nonexpert area. The third interview explored the teaching of specific, middle school level, skill lesson in both expert and non-expert areas. The final interview was a retrospective interview and focused on a recently taught unit. The purpose of this interview was to assess the fit between the hypothetical units and the teachers' actual practice.

Data Analysis. The interviews were audiorecorded and then transcribed by the investigators. A total of 40 interviews (4 interviews X 10 teachers) were completed and transcribed. Data were analyzed using the constant comparative analysis recommended by Glaser & Strauss (1967). This required summarizing the question responses into descriptive themes and categories. These response categories were further divided into expert and non-expert subject areas. In comparing the expert and nonexpert categories, notes were taken regarding theoretical notions pertinent to expertise and pedagogical content knowledge. Next, the categories and their properties were integrated and scrutinized for "underlying uniformities" (Glaser & Strauss, 1967, p. 10). These underlying uniformities identified differences between the way teachers taught subject matter in which they were expert and nonexpert. Finally, in order to address the central concern of this study, the themes or

uniformities were reviewed in light of Grossman's (1990) definition of pedagogical content knowledge.

Findings

The purpose of this study was to discern the influence of subject matter expertise on physical educators' pedagogical content knowledge. The findings of this study are, therefore, presented in the context of similarities and differences in pedagogical content knowledge attributable to teachers' level of subject matter expertise. Grossman (1990) defines pedagogical content knowledge as composed of four components: (a) knowledge and beliefs about the purposes for teaching a subject at different grade levels, (b) knowledge of students' understanding, conceptions, and misconceptions of subject matter, (c) knowledge of curriculum materials available for teaching a subject and knowledge of horizontal and vertical curricula for the subject, and (d) knowledge of instructional strategies and representations for teaching particular topics. These four components formed the analytic framework for interpreting and presenting the findings.

Grade level purposes. Grossman (1990) defined this component of pedagogical content knowledge as the knowledge and beliefs about the purposes for teaching a subject at different grade levels. These conceptions are reflected in the teachers' objectives for teaching particular subject matter to particular groups of students. For the teachers of this study, subject

expertise did not appear to influence the formulation of student learning goals. Put another way, the purposes for student learning were similar regardless of the teachers' subject expertise. The teachers consistently identified gaining basic knowledge and skills of particular subject matter as the primary student learning goal. One teacher responded to the question "What goals would you set for your students?" as:

> To gain an understanding of how softball is played, rules, playing field, etiquette, and also for everyone to gain basic skills in hitting, throwing, and fielding.

Interestingly, the teachers of this study did not conceive of subject matter, regardless of their expertise, as being grade level specific. Rather than grade level dictating student learning goals as suggested by Grossman (1990), the teachers in this study seemed to hold a more developmental perspective. That is, they saw students as beginning, intermediate or advanced knowers of the subject. As one teacher told us

> My goal (for students) would be to learn how to do the skill correctly and to experience some success. And like I said, it is not all that hard, so an intermediate swimmer would be able to pick up (the skills) quickly.

Students' understanding. Grossman (1990) explained the second component of pedagogical content knowledge as a teacher's knowledge of the students' understanding, conceptions, and

misconceptions of particular topics within a subject matter. In order for teachers to effectively generate appropriate explanations, presentations, and demonstrations, teachers must have some knowledge of what the students already know about a subject area and what difficulties they might encounter.

The teachers' level of subject matter expertise appeared to play no role in the analysis of students' previous knowledge of the subject matter. The teachers uniformly perceived the students they taught in public schools to have little understanding of or previous experience with physical education content, regardless of the topic. One teacher reported:

> I don't think really they would know that much. Maybe they have seen some track and field events on TV at times or they may have brothers and sisters that have run track on the high school level and basically that's pretty much all I would think they would know unless they had parents who ran or jogged as a hobby. They wouldn't really have a great knowledge of what it was all about, I would think.

There was a marked difference, however, in perceptions of student learning problems. Teachers in expert subject areas thought their greatest problem would be motivating the students to learn. Interestingly, teachers' subject expertise seems to lead to the conviction that they can teach their expert subject

to any group of students *if* the students are willing to learn. One teacher described this experience:

> 'All I want you (the students) to do is hit a dozen serves back to that court.' They look at you like you're crazy because that's not playing to them; let's get this junk over with so we can start a game. . . The first thing is, like I said, motivation.

Teachers of nonexpert subject matter identified students' mastery of the task and practice opportunities as potential problem areas. In contrast, the teachers in expert subjects felt they knew or could devise activities to overcome student difficulties, whereas the teachers of nonexpert subject matter anticipated student abilities as a problem source. For example, one teacher who was not expert in teaching badminton speculated that his major pedagogical problem would be:

> Probably just (the students') hand-eye coordination--especially with the shuttlecock because the air resistance makes them come slower or faster than you think. The timing, coordination will be different.

Experts in the subject area believed they could overcome problems of student inability with remedial or supplementary activities, nonexperts saw no way around the problem.

Curricular materials and levels. The third component of pedagogical content knowledge, as defined by Grossman (1990),

includes the knowledge of curriculum materials available for teaching a particular subject matter, as well as knowledge regarding different curricular levels. Curriculum materials include the teachers' knowledge of books, equipment, and teaching aids available to them for use in teaching particular subject matter. Curricular levels represent the subject's vertical and horizontal curriculum and the teachers' cumulative knowledge of what students have studied in the past and what they are likely to learn in the future.

In planning and conducting a class, the teachers in this study, surprisingly, identified similar equipment, supplies, teaching aids, and curricular materials, regardless of their subject expertise. A stark contrast did, however, appear in planning and organizing instructional activities. Subject experts quickly and easily outlined a rich progression of skills and concepts that began with the simple and led to the complex. They were able to identify and describe in specific, technical terms, a series of skills that were interdependent and progressive (what Grossman, (1990) termed horizontal curriculum). In describing how she lesson organization, one teacher said:

> I would set up the groups and probably have varied stations around the gym floor where they will work on different types of passes. I'd have them in circle groups, I'd also have areas where they would dribble down and have to complete a

bounce pass to another player on the floor. After that we would put a defender in there where they would have to bounce pass by a defender. We would start basic and progress.

Teachers in their expert areas organized skills and learning activities in a detail that accounted for variations in environmental conditions. Contingency plans that demonstrated dexterity of thought and depth of knowledge were easily suggested. Confident they could accommodate most any condition they might face, teachers showed little concern for advanced planning in their expert subjects. As an example, we were told:

I wouldn't have to prepare a lot. I have done it for so many years. I not only teach it, but I coach it. I have been to clinics. I know the rules. There will not be much to prepare.

Subject experts also showed little concern for the opinions of others regarding either the subject matter or its pedagogy. However, in nonexpert subjects, teachers held far greater concern for researching the subject and advanced planning. They identified outside experts (peers, other teachers, or even students) as a primary source of help. As one teacher put it:

I would definitely go to the library and get books on rules and how to teach things. Or I would talk to another teacher who has taught it before and see what they do.

Instructional strategies. The final component of pedagogical content knowledge includes a teachers' knowledge of pedagogical strategies and presentations to effectively teach the subject matter (Grossman, 1990). Specific to instructional strategies, teachers of expert subject matter revealed a greater ability to accommodate a range of learner skills and abilities. One teacher gave us this example:

> Lots of times what I do after I initially get everyone on the floor with a basketball in their hand and just have them dribble around the gym at their own speed, then I can look around and very quickly spot the kids who are the very higher skilled kids. And those kids I will give them a color card, I have cards that I put colors on; red, yellow, green, double green stripe, double red stripe. And I will hand them a card and then I go around and give the other kids a card. Then I say 'red group over here,' 'green group over here' and so forth. That quickly spreads people out and gives me a chance to walk around the floor looking at the skills and making assessments. It's better, from my past experience, to immediately identify my higher skilled kids and spread them out among the others.

Differences between teaching an expert subject area and a nonexpert area also manifested in the quantity and variety of classroom learning activities. Teachers in their expert subjects

not only identified a greater number of activities, but described them in richer detail.

> I usually start with the fundamentals and put the kids in groups and usually in lines. I spread them out over the length of the gym floor. We work on the fundamentals of dribbling, dribbling with a partner who is just there with you and giving you feedback on what you are doing correctly; also the partner is looking for things that the person can do to improve their dribbling. In putting kids into groups I would use a lot of stations. At one station they may work on passing and catching skills. At another station it may be shooting a particular type of shot. At another station its dribbling, maybe dribbling through cones or doing a dribble tag game and so forth.

In nonexpert subjects, teachers identified fewer activities and described them in rather general ways.

Surprisingly, the teachers showed no difference between their expert and nonexpert areas in the techniques they would use in evaluating student learning. This may, however, be a function of the criteria used to evaluate students in physical education rather than indicative of one's "expert" ability to evaluate student learning. When asked the criteria she used to evaluate students in her expert subject area, a teacher responded:

"Probably on improvement. It is not fair to grade someone just because they are not a skilled player."

In her response to evaluating a nonexpert subject area, the same teacher replied:

> Pretty much the same thing. I would have it on improvement. I don't think it is fair to penalize someone just because they are less skilled or reward someone just because they happened to grow up playing badminton.

One obvious difference between expert and nonexpert subject areas was the level of comfort and enthusiasm expressed by the teachers for teaching their expert subjects. Their trepidation in teaching subjects in which they had little expertise was equally noticeable. In response to the question, what would you do if assigned your non-expert area (in this case flag football), one teacher said:

> I would just do anything I could to try and not teach flag football. Anything. First of all I haven't even seen it played. I don't even know how to play it at all. I don't have a clue. So I first of all would talk to the principal and talk with my colleagues first to see if I could con someone into doing that.

Contrast this to her response for teaching her expert area:

> I would be ecstatic. I mean I would be so happy I would kind of be ticked off if they didn't ask me to teach that in

the first place. Oh I would be really thrilled. I have had that happen to me and it is fun to have to take over something that you just feel so comfortable with compared to the other scenario (i.e., flag football)

Discussion

The findings of this study deepen our understanding of how teachers organize and present subject matter in areas of expertise and nonexpertise. Understanding how teachers learn and organize particular aspects of subject matter is useful information for policy makers and teacher educators who must select and offer teachers applicable, relevant knowledge for their classroom practice. Further, this study reveals the influential role subject expertise plays in pedagogical content knowledge.

The findings suggest there are significant differences between teaching expert and nonexpert subject matter areas. These differences include: (a) recognition of problems in student learning, (b) detail in planning and organizing subject matter, (c) comfort and enthusiasm for teaching, and (d) the ability to accommodate a range of learner skills and abilities. Subject expertise also permits teachers to better identify problems in student learning and provide specific remedies to overcome student difficulties. Based on the findings of this study, we are in agreement with those who support deepening teachers' subject

matter expertise as a way of improving teaching (Ball, & McDiarmid, 1990; Grossman, 1990; Marks, 1990; Shulman, 1986, 1987).

REFERENCES

Ball, D.L. & McDiarmid, G.W. (1990). The subject-matter preparation of teachers. In W.R. Houston (Ed.), Handbook of research on teacher education (pp. 437-449). New York: MacMillan.

Berliner, D. C. (1986). In pursuit of the expert pedagogue. Educational Researcher, 15(7),5-13.

Brophy, J. (1991). Advances in research on teaching: Teachers' knowledge of subject matter as it relates to their teaching practice (Vol. 2). Greenwich, CT: JAI Press.

Glaser, B., & Strauss, A. (1967). The discovery of grounded theory: Strategies for qualitative research. Chicago, IL: Aldine.

Grossman, P. L. (1990). The making of a teacher: Teacher knowledge and teacher education. New York: Teachers College Press.

Marks, R. (1990). Pedagogical content knowledge: From a mathematical case to a modified conception. Journal of Teacher Education, 41(3), 3-11.

Rovegno, I. (1992). Learning to teach in a field-based methods course: The development of pedagogical content knowledge. Teaching and Teacher Education, 8(1), 69-82.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-21.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-22.